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Earth Resource

Building a Functional, Integrated GIS/Remote Sensing Resource Analysis and Planning System

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Most state governments and many local jurisdictions express a need to encompass the disparate mapping and resource planning activities into a centralized system. Several states have made remarkable progress in establishing an automated geographic information system (GIS) to meet the challenge. Other states, perhaps with more complex infrastructures or smaller budgets, or without a driving force, still look to the day when they might begin.

This paper stresses two points: (1) to be an effective tool for resource analysis and planning, a GIS needs to be integrated with a digital remote sensing capability; and (2) to be truly functional, the paired system needs to be driven by grass-roots local needs. A case study in Utah will be used as a working model.

Several factors have conspired to bring these needs about: our expanded knowledge of resource dynamics, our experience with risks associated with lack of mapping and planning, the emergence of sophisticated remote sensing technologies to map and analyze the resources, and the emergence of computer technology to assimilate vast quantities of spatial and attribute data in GIS systems at controlled scales. The need for "vertically" integrated coordination between agencies from federal to local, and for "horizontally" integrated coordination from the local, to state, to regional level is self evident.

A potential pitfall for a state GIS office is the temptation to go out and digitize every map in sight to add to the library of accessible spatial data in case somebody may be able to use it. The tendency for the office to "sell" the system and recruit digitizing personnel may end in disappointment and/or files of questionably useful maps. To let the system be driven by specific resource questions in particular places might bear more palatable fruit.

Two basic questions are: (1) What data should be acquired to directly serve the resource planning needs and thus to make functional use of the GIS? and (2) How shall that data be acquired and placed into the system? The first question calls for a user-defined set of resource data needs, and the second calls for an integrated remote sensing/GIS system to acquire the data and get it into the GIS for analysis.

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The case study presented is couched in a Soil Conservation District (SCD) in northern Utah. A group of agency representatives responsible for the condition and use of various resources in the SCD have assembled a prioritized list of resource information and planning needs. It was determined that the most fundamental data sets to be entered into the GIS analysis system in the first round were:

1. Land use/Land cover
2. Geomorphic/soil unit data
3. Hydrologic unit data
4. Digital terrain

The cheapest way to obtain acceptable land use/cover data in mountain areas was through Landsat digital classification (using a PRIME/ELAS system). The best way to get accurate data for the agricultural and built-up areas of the valleys was through recent photography, manually interpreted. The latter was digitized and merged with the Landsat data as a single "overlay" with integrated legend (using modified ELAS modules on a Tectronics digitizer). The results were segmented digitally into quadrangle chunks. Geomorphic/soil units were determined from B/W stereo photos and field work, coupled with Soil Conservation Service maps. They were digitized and added to the system. In similar fashion the hydrologic units were determined and entered. Relevant attributes per polygon and line were added. Finally, elevation, slope, and aspect (DMA) data were added.

The data were all formatted to enter the state's PRIME/ARC-INFO GIS. The data are now being interrogated for resource management decisions related to such issues as agricultural preservation, urban expansion, soil erosion control, and dam siting. The procedure and results will be illustrated.